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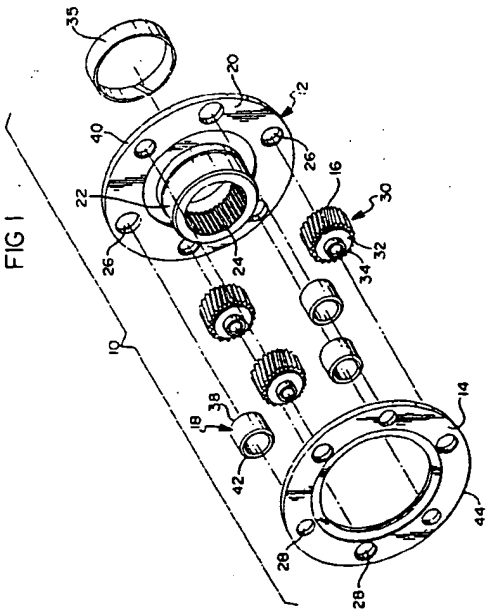
(54) Planetary gearset carrier assembly.

(57) A carrier for an automatic transmission of a motor vehicle is provided. The carrier (10) comprises a hub (12), an annular face plate (14), a plurality of posts (18), and a plurality of planetary gears (16). The hub (12) includes a collar (22) having internal teeth (24) adapted to mesh with an input or an output shaft, and a disc (20) attached to the collar. The posts (18) are generally cylindrical, and extend between the hub (12) and the face plate (14) substantially within the respective perimeters of the hub and the face plate. The planetary gears (16) are disposed in a gear pocket between the hub (12) and the face plate (14), with each planetary gear (16) being mounted on an associated pinion shaft and adapted to mesh with both a sun gear and a ring gear. A method of making a carrier for an automatic transmission is also provided.

FIG 1



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This invention relates to carriers for automatic transmissions, and more particularly to such a carrier which has a series of structural support posts capacity discharge welded in place to join a hub and a face plate.

Automatic transmissions for motor vehicles commonly use torque-converter couplings with planetary gear units that can supply one or two gear reductions and reverse, depending on the design, by simultaneously engaging or locking various elements of the planetary gear unit. Typically, a simple planetary gear unit includes a sun gear, a ring gear, and a carrier which supports a plurality of shafts on which are mounted planet or pinion gears. The planetary gearset carrier provides the structure to carry torque through the pinion gears and shafts to an output member, and therefore must be rigid enough to provide gear location without deflection.

Conventional planet carriers are known which are either one piece castings, castings fastened together such as by riveting, or steel multi-piece constructions joined together by laser welding or electron beam welding. For example, the A4LD carrier used by Ford Motor Company, the assignee of the present invention, utilises a stamped plate having a bent leg which is capacity discharge welded onto radial projections in a hub portion of the carrier.

The present invention is a carrier for an automatic transmission. The carrier comprises a hub, an annular face plate, a plurality of posts, and a plurality of planetary gears. The hub includes a collar having internal teeth adapted to mesh with an input or an output shaft, and a disc attached to the collar. The posts are generally cylindrical, and extend between the hub and the face plate substantially within the respective perimeters of the hub and the face plate. The planetary gears are disposed in a gear pocket between the hub and the face plate, with each planetary gear being mounted on an associated pinion shaft and adapted to mesh with both a sun gear and a ring gear.

The invention also includes a method of making a carrier for an automatic transmission. The method comprises providing a hub, face plate, and a plurality of planetary gears in a gear pocket between the hub and the face plate. A plurality of generally cylindrical posts having ends shaped for controlled weldment are then capacity discharge welded between the hub and the face plate substantially within their respective perimeters to maintain the gear pocket therebetween.

A carrier embodying the invention has an effective multiple piece construction which is very strong, and is easy to manufacture at a relatively low cost.

Further a carrier allows flexibility of design in the choice of number of pinions to be used, and a choice of a wide range of materials for use in the hub and the face plate.

The present invention also provides a method of making a carrier of the type described above which utilises a welding machine having high efficiency, low down time, and is relatively insensitive to power fluctuations.

The invention will now be described further, by way of example, with reference to the accompanying drawings in which:

Figure 1 is an exploded view of a carrier according to the present invention for an automatic transmission;

Figure 2 is a plan view of the carrier;

Figure 3 is a cross sectional view of the carrier taken along line 3-3 in Figure 2;

Figure 4 is a top view of a post of the carrier; and

Figure 5 is a cross sectional view of the post taken along line 5-5 in Figure 4.

With reference to the drawings, the preferred embodiments of the present invention will be described. Figures 1 through 3 show a carrier 10 according to the present invention for an automatic transmission of a motor vehicle. The carrier comprises a hub 12, an annular face plate 14, a plurality of planetary gears 16, and a plurality of posts 18.

The hub 12 includes an annular disc 20 and an axially extending collar 22 integrally attached to the disc. The collar 22 has internal teeth 24 adapted to mesh with an input or an output shaft, depending on the purpose to which the carrier 10 is dedicated, as is well known in the art. The disc 20 is provided with a series of holes 26 spaced equiangularly around the collar 22. In a preferred embodiment shown in Figures 1 through 3, there are six holes 26 provided to accept either a structural support post or a pinion gear shaft, as described below.

The face plate 14 is a substantially planar stamping, and is also preferably provided with six holes 28 therethrough. Gear assemblies 30, each of which comprises a pair of thrust washers 32 and a helical planetary gear 16 mounted by needle bearings (not shown) on a pinion shaft 34, are disposed in a gear pocket defined between the hub 12 and the face plate 14. The planetary gears 16 are then in a position to mesh with both a sun gear rotatable on the collar 22, and a ring gear situated around the circumference of the planetary gears, as is known in the art. A bronze bushing 35 is provided for piloting the carrier 10 to the ring gear.

The pinion shafts 34 extend between the hub 12 and the face plate 14, and are upset on the respective exterior sides of the hub and the face plate to form a retaining flange 36, as shown most clearly in Figure 2. Because the interior side of the disc 20 can be sufficiently smoothed prior to assembly by machining, the thrust washers 32 are preferably brass. Although three gear assemblies 30 are shown in the preferred embodiment shown in Figures 1 through 3, it should be understood that the carrier 10 can be provided with a sufficient number of holes oriented to accommodate four or more gear assemblies.

The posts 18 are generally cylindrical and hollow, as shown in Figures 4 and 5, and extend between the disc 20 of the hub 12 and the face plate 14. A first end 38 of each post 18 is attached to the disc 20 substantially within the perimeter 40 of the disc, while an opposite second end 42 of each post is attached to the face plate 14 substantially within the perimeter 44 of the face plate. The cylindrical shape of the posts 18 provides a relatively high strength to weight ratio, and permits the posts to be positioned for welding without regard for their angular orientation.

The carrier assembly posts 18 are all welded in place at the same time using a capacity discharge weld. For this purpose, the posts 18 are preferably a lower carbon steel, for instance 1010 steel, with the ends 38 and 42 shaped to a pointed rim by cold heading or screw machining as shown in Figures 4 and 5 for controlled weldment. The hub 12 and the face plate 14 are preferably formed from a higher carbon steel, for instance 1040 steel. Alternatively, the hub and/or the face plate can be formed from powdered metals.

A 40 kilowatt-second capacity discharge welding machine, available from the Schlemmer company of Essen, Germany, is suitable for performing the capacity discharge weld function. It has been found that this welder has a high efficiency, low down time, and is relatively insensitive to power fluctuations. It has also been found that the heat affected zone resulting from this capacity discharge welding operation is localised, providing minimal distortion. Also, sensitivity to contamination is greatly reduced compared to alternate welding processes such as laser or electron beam welding.

Once welded, the posts 18 provide the structure to the carrier 10. The present invention provides an effective multiple piece carrier construction which is very strong, and is easy to manufacture at a relatively low cost. The present invention also allows flexibility of design, in that either three or four pinions can be accommodated, and a wide range of materials can be selected for use in the hub and the face plate. The most desirable materials are those which provide good and consistent machinability. The present invention also provides good control of the gear pocket width control.

The present invention also includes a method of making a carrier in accordance with the apparatus described above. The method comprises providing a hub and a substantially planar face plate, and providing a plurality of planetary gears in a gear pocket between the hub and the face plate. A plurality of generally cylindrical posts are then welded, preferably by capacity discharge welding, between the hub and the face plate substantially inside the respective perimeters of the hub and face plate. A first end of each post is preferably welded to the hub, while a second end of each post is welded to the face plate, to maintain the gear pocket therebetween.

Claims

1. A carrier for an automatic transmission, the carrier (10) comprising:
   a hub (12);
   a face plate (14);
   a plurality of posts extending between the hub (12) and the face plate to maintain a gear pocket therebetween; and
   a plurality of planetary gears (16) disposed in the gear pocket and adapted to mesh with both a sun gear and a ring gear.

2. A carrier as claimed in claim 1, wherein the hub includes a collar and a disc attached to the collar.

3. A carrier as claimed in claim 1 or 2, wherein the disc and the face plate both have a perimeter, and the posts extend between the disc and the face plate substantially within their respective perimeters.

4. A carrier as claimed any one of claims 1 to 3, wherein there are three posts extending between the hub and the face plate.

5. A carrier as claimed in any one of the preceding claims, wherein the posts have a first end and a second end shaped for controlled weldment.

6. A carrier as claimed in any one of the preceding claims, wherein the posts are welded to the hub and to the face plate.

7. A carrier as claimed in any one of claims 1 to 5, wherein the posts are capacity discharge welded to the hub and to the face plate.

8. A carrier for an automatic transmission, the carrier comprising:
   a hub including a collar and a disc attached to the collar, the collar having internal teeth adapted to mesh with an input or an output shaft, the disc having a perimeter;
   an annular, substantially planar face plate having a perimeter;
   a plurality of generally cylindrical posts extending between the hub and the face plate substantially within their respective perimeters; and
   a plurality of planetary gears disposed in a gear pocket between the hub and the face plate, each planetary gear being mounted on an associated pinion shaft and adapted to mesh with both a sun gear and a ring gear.

9. A method of making a carrier for an automatic transmission, the method comprising:

providing a hub;

providing a face plate;

providing a plurality of planetary gears in a gear pocket between the hub and the face plate; and

welding a plurality of posts between the hub and the face plate to maintain the gear pocket therebetween.

10. A method as claimed in claim 9, wherein the welding step comprises capacity discharge welding.

11. A method as claimed in claim 9, wherein the welding step comprises welding a first end of each post to the hub and welding a second end of each post to the face plate.

12. A method as claimed in claim 9, wherein the hub and the face plate each have a perimeter, and the welding step comprises welding the posts inside the respective perimeters of the hub and the face plate.

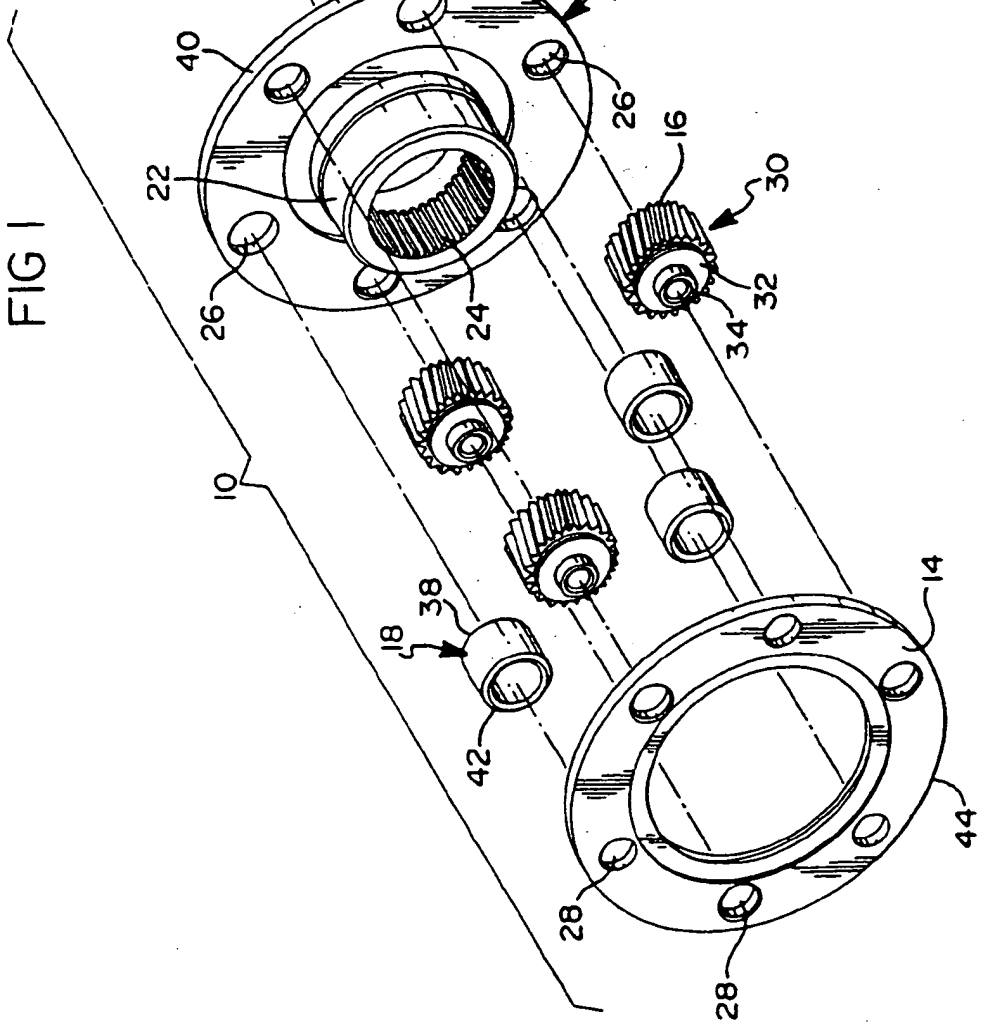


FIG 1

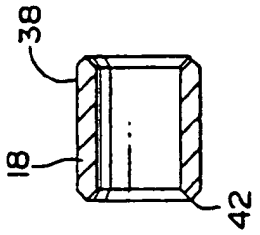


FIG 5

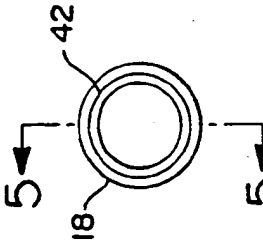
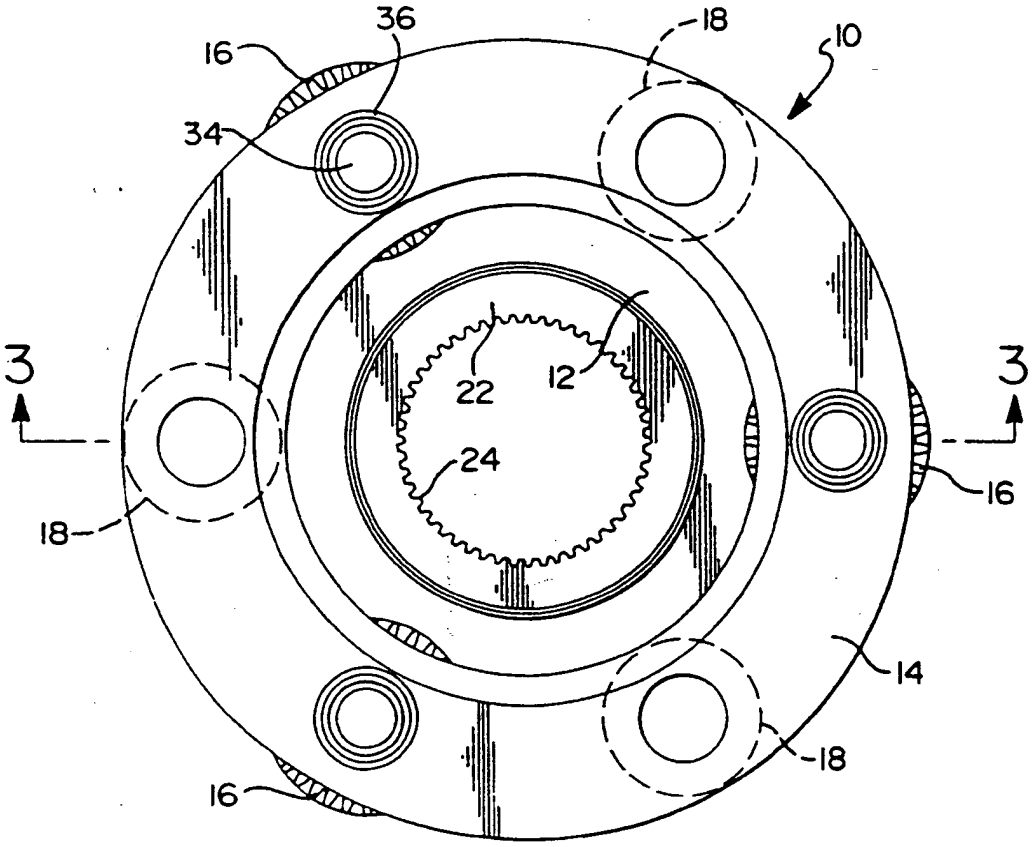


FIG 4

FIG 2



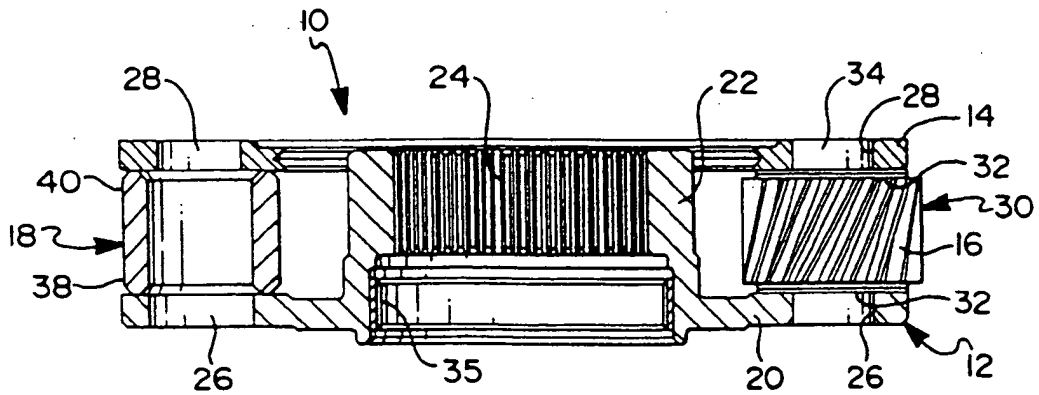


FIG 3

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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 1831

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X Y	CH-A-415 215 (FICHTEL & SACHS) * the whole document *	1-4,8 9	F16H57/08
Y A	FR-A-2 299 566 (ZAHNRADFABRIK FRIEDRICHSHAFEN A.G.) * the whole document *	9 5,6,11, 12	
A	EP-A-0 230 522 (FORD WERKE) * abstract *	5-7,10	
A	EP-A-0 271 416 (ATELIERS DE MECANIQUE GENERALE) * the whole document *	1,8,9	
A	GB-A-1 205 009 (GENERAL MOTORS CORP.) * the whole document *	1,8,9	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
F16H
B23K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 July 1994	Vingerhoets, A

CATEGORY OF CITED DOCUMENTS
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